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<110> Allen, Steve
Lee, Jian Ming

<120> Plant Protein Kinases

<130> BB-1171

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<150> 60/092, 438
<151> July 10, 1998

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<213> *Oryza sativa*

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 Leu Pro Ser Thr Pro Pro Arg Gln Gln Ala Gln Ala Gln Gln Gln
 35 40 45
 Val Gly Thr Pro Arg Arg Arg Gly Ser Lys Ser Gly Ser Thr Thr Pro
 50 55 60
 Gly His Gln Thr Pro Gly Val Ala Trp Pro Ser Pro Tyr Pro Ser Gly
 65 70 75 80
 Gly Ala Ser Pro Leu Pro Ala Gly Val Ser Pro Ser Pro Ala Arg Ser
 85 90 95
 Thr Pro Arg Arg Phe Phe Lys Arg Pro Phe Pro Pro Pro Ser Pro Ala
 100 105 110
 Lys His Ile Lys Ala Thr Leu Ala Lys Arg Leu Gly Gly Gly Lys Pro
 115 120 125
 Lys Glu Gly Thr Ile Pro Glu Glu Gly Gly Val Gly Ala Gly Gly Gly
 130 135 140
 Gly Gly Gly Ala Ala Asp Gly Ala Glu Thr Glu Arg Pro Leu Asp Lys
 145 150 155 160
 Thr Phe Gly Phe Ser Lys Asn Phe Gly Ala Lys Tyr Glu Leu Gly Lys
 165 170 175

Glu Val Gly Arg Gly His Phe Gly His Thr Cys Ser Ala Val Val Lys
 180 185 190
 Lys Gly Glu Tyr Lys Gly Gln Thr Val Ala Val Lys Ile Ile Ala Lys
 195 200 205
 Ala Lys Met Thr Thr Ala Ile Ser Ile Glu Asp Val Arg Arg Glu Val
 210 215 220
 Lys Ile Leu Arg Ala Leu Ser Gly His Asn Asn Leu Val Lys Phe Tyr
 225 230 235 240
 Asp Ala Cys Glu Asp Gly Leu Asn Val Tyr Ile Val Met Glu Leu Cys
 245 250 255
 Glu Gly Gly Glu Leu Leu Asp Arg Ile Leu Ala Arg Gly Gly Arg Tyr
 260 265 270
 Thr Glu Glu Asp Ala Lys Ala Ile Val Val Gln Ile Leu Ser Val Val
 275 280 285
 Ala Phe Cys His Leu Gln Gly Val Val His Arg Asp Leu Lys Pro Glu
 290 295 300
 Asn Phe Leu Phe Thr Thr Arg Asp Glu Asn Ala Pro Met Lys Leu Ile
 305 310 315 320
 Asp Phe Gly Leu Ser Asp Phe Ile Arg Pro Asp Glu Arg Leu Asn Asp
 325 330 335
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 Tyr Ser Met Glu Ala Asp Ile Trp Ser Ile Gly Val Ile Thr Tyr Ile
 355 360 365
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 370 375 380
 Phe Arg Ser Val Leu Arg Ala Asp Pro Asn Phe Asp Asp Ser Pro Trp
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 Pro Thr Val Ser Ala Glu Ala Lys Asp Phe Val Lys Arg Phe Leu Asn
 405 410 415
 Lys Asp Tyr Arg Lys Arg Met Thr Ala Val Gln Ala Leu Thr His Pro
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 Trp Leu Arg Asp Glu Gln Arg Gln Ile Pro Leu Asp Ile Leu Ile Phe
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 Arg Leu Ile Lys Gln Tyr Leu Arg Ala Thr Pro Leu Lys Arg Leu Ala
 450 455 460
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 465 470 475 480
 Lys Leu Gln Phe Lys Leu Leu Glu Pro Arg Asp Gly Phe Val Ser Leu
 485 490 495

Asp Asn Phe Arg Thr Ala Leu Thr Arg Tyr Leu Thr Asp Ala Met Lys
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Glu Ser Arg Val Leu Glu Phe Leu His Ala Leu Glu Pro Leu Ala Tyr
515 520 525

Arg Arg Met Asp Phe Glu Glu Phe Cys Ala Ala Ala Ile Ser Pro Tyr
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Gln Leu Glu Ala Leu Glu Arg Trp Glu Glu Ile Ala Gly Thr Ala Phe
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Gln Gln Phe Glu Gln Glu Gly Asn Arg Val Ile Ser Val Glu Glu Leu
565 570 575

Ala Gln Glu Leu Asn Leu Ala Pro Thr His Tyr Ser Ile Val Gln Asp
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Trp Ile Arg Lys Ser Asp Gly Lys Leu Asn Phe Leu Gly Phe Thr Lys
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 aagcacatc gcgcgctgct cggccgengc cacggttccg tcaagccgaa cgaagcctcc 180
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Ser Asn Pro Ser Ser Xaa Pro Leu Xaa Ile Phe Lys Xaa Pro Phe Pro
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Pro Pro Ser Pro Ala Lys His Ile Arg Ala Leu Leu Ala Arg Xaa His
35 40 45

Gly Ser Val Lys Pro Asn Glu Ala Ser Ile Pro Glu Ala Ser Xaa Cys
50 55 60

Glu Leu Gly Leu Asp Lys Ser Phe Gly Phe Ala Lys Gln Phe Ser Ala
65 70 75 80

His Tyr Glu Leu Ser Asp Glu Xaa Gly Arg Gly His Phe Gly Tyr Thr
85 90 95

Cys Ser Ala Lys Gly Lys Gly Ala Phe Lys Gly Leu Asn Val Ala
100 105 110

Val Lys Val Ile Pro Lys Ala Lys Met Thr Thr Ala Ile Ala Ile Glu
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Asp Val Arg Arg Glu Val Lys Ile Leu Arg Ala Leu Thr Gly His Lys
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Asn Leu Val Gln Phe Tyr Glu Ala Tyr Glu Asp Asp Asp
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<212> DNA
<213> Triticum aestivum

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His Leu Gln Gly Val Val His Arg Asp Leu Lys Pro Glu Asn Phe Leu
  35          40          45

Phe Ser Ser Lys Glu Glu Asn Ser Pro Leu Lys Val Ile Asp Phe Gly
  50          55          60

Leu Ser Asp Phe Val Lys Pro Asp Glu Arg Leu Asn Asp Ile Val Gly
  65          70          75          80

Ser Ala Tyr Tyr Val Ala Xaa Glu Val Leu His Arg Ser Tyr Gly Thr
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Glu Gly Asp Met Xaa Ser Ile Gly Val Ile Ala Tyr Ile Leu Leu
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<213> Zea mays

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| cctccctccc cgccggag ttggaggagg gagaggggac aagcttccg gccgcacgc | 180 |
| cgacgcggac cggcgccga cacgatccgg tggatcaagt gcatcacacc tttagggagg | 240 |
| ccccttggac agcagttgt gctgcaaatt ctatatacgct ctgtcgacgc atggcctcg | 300 |
| tggcgctggc acgctttct ttgggatttc agaatggcac aagttctagc aytgaccacag | 360 |
| atcgctttcc caacgagttt ggcagttatga gatataaggga cgacaaggac gttgaagata | 420 |
| ttttagtcaa tggcaatggg gggagccctg gtcataatcat agtgaccacg attgatggga | 480 |
| gaaatgggca ggcggaaagcag accatttagtt acatggctga gcggttggta gtcatgggt | 540 |
| ccttcggAAC cgttttccag gccaagtgtc ttggaaactgg tgagaccgt a gctataaaaa | 600 |
| aggttcttca agacaagaga tacaagaatc gtgagctgca aaccatgcga gtygcttgacc | 660 |
| acccaaatgt ggtggctcta aagcactgtt tcttctcaaa gactgagaaa gaggagctt | 720 |
| acctaattt ggtgtttag gatgtaccgg agactgctca tcgtgtcatc aaacattaca | 780 |
| acaagatgaa ccagcgcattt cctttagatt atgcaaaact gtataatgtat cagatttgt | 840 |
| gaggcttggc atacattcac aacagcattt gagggtgtccca caggacatt aagccgcaaa | 900 |
| atctccttggt taatcctcat acccatcagc taaaatttggt tgacttggc agcgcgaaag | 960 |
| ttctggtaaa aggcgaacca aacatttctt acatctgttc taggtactac agagctccag | 1020 |
| agctcatatt tgggtgtact gaatacacaa cagccattga tgggttggct gctggctgt | 1080 |
| tgctcgctga gctgcttcta ggacagcctc tggccctgg agaaagcggg gttgatcagc | 1140 |
| ttgttggaaat catcaagggtt ctgggacac ccacacgtga agaaattaag tgcattgaatc | 1200 |
| caaattatac cgagtttaaa ttcccgcaaa tcaaagctca cccatggcat aagatattcc | 1260 |
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| aacttcggtc gactgctttt gaaagcattgg tccatccgtt cttttagtcaa cttcgggatc | 1380 |
| caaacacccg ctaccgaat ggtcggtttc ttccgctct cttcaatttt aagccccatg | 1440 |
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| aatgtgcctt cgtagggtgg tggatctctgg ataagaggat gacgactcga tgattagctg | 1560 |
| aggaccaagt taatgtctgt tagaaactgc cggagatcga cattggcaga tgggtgtgg | 1620 |
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Met Ser Ile Arg Asp Asp Lys Asp Val Glu Asp Ile Val Val Asn Gly
 35 40 45

Asn Gly Ala Glu Pro Gly His Ile Ile Val Thr Ser Ile Asp Gly Arg
 50 55 60

Asn Gly Gln Ala Lys Gln Thr Ile Ser Tyr Met Ala Glu Arg Val Val
 65 70 75 80

Gly His Gly Ser Phe Gly Thr Val Phe Gln Ala Lys Cys Leu Glu Thr
 85 90 95

Gly Glu Thr Val Ala Ile Lys Lys Val Leu Gln Asp Lys Arg Tyr Lys
 100 105 110

Asn Arg Glu Leu Gln Thr Met Arg Val Leu Asp His Pro Asn Val Val
 115 120 125

Ala Leu Lys His Cys Phe Phe Ser Lys Thr Glu Lys Glu Glu Leu Tyr
 130 135 140

Leu Asn Leu Val Leu Glu Tyr Val Pro Glu Thr Ala His Arg Val Ile
 145 150 155 160

Lys His Tyr Asn Lys Met Asn Gln Arg Met Pro Leu Ile Tyr Ala Lys
 165 170 175

Leu Tyr Met Tyr Gln Ile Cys Arg Ala Leu Ala Tyr Ile His Asn Ser
 180 185 190

Ile Gly Val Cys His Arg Asp Ile Lys Pro Gln Asn Leu Leu Val Asn
 195 200 205

Pro His Thr His Gln Leu Lys Leu Cys Asp Phe Gly Ser Ala Lys Val
 210 215 220

Leu Val Lys Gly Glu Pro Asn Ile Ser Tyr Ile Cys Ser Arg Tyr Tyr
 225 230 235 240

Arg Ala Pro Glu Leu Ile Phe Gly Ala Thr Glu Tyr Thr Thr Ala Ile
 245 250 255

Asp Val Gly Ser Ala Gly Cys Val Leu Ala Glu Leu Leu Gly Gln
 260 265 270

Pro Leu Phe Pro Gly Glu Ser Gly Val Asp Gln Leu Val Glu Ile Ile
 275 280 285

Lys Val Leu Gly Thr Pro Thr Arg Glu Glu Ile Lys Cys Met Asn Pro
290 295 300

Asn Tyr Thr Glu Phe Lys Phe Pro Gln Ile Lys Ala His Pro Trp His
305 310 315 320

Lys Ile Phe His Lys Arg Met Pro Ala Glu Ala Val Asp Leu Val Ser
325 330 335

Arg Leu Leu Gln Tyr Ser Pro Lys Leu Arg Ser Thr Ala Leu Glu Ala
340 345 350

Leu Val His Pro Phe Phe Asp Glu Leu Arg Asp Pro Asn Thr Arg Leu
355 360 365

Pro Asn Gly Arg Phe Leu Pro Pro Leu Phe Asn Phe Lys Pro His Glu
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Ala Arg Lys Gln Cys Ala Phe Val Gly Trp
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| gggagatcca | tccctgtgga | gaggaggag | ggaggaagga | ggcggtggag | gaggagaggt | 120 |
| tgaccgatag | atccattgcg | gagttgagtg | ttgatgcaaa | gctgattcgc | catcgtag | 180 |
| cttttataaa | gagatgggtt | cagtangggt | tgcgccgtct | gggttaaaca | acacgactan | 240 |
| caccagcatg | ggtgcgtgaga | agttgcctga | tcaagatgcatt | gatctgaaga | taaggacgaa | 300 |
| taaggaantt | gaacgactat | tattaacngc | aanggaacag | aaancggcca | cataattgtc | 360 |
| acaactactg | gnngcanaaa | tggtcancgg | aaacanacag | ttagctacat | ggctgancgt | 420 |
| attgttagggc | aagggtcatt | tgggattgtc | ttccaagcaa | aattctggag | acaaggtgag | 480 |
| acagttgcata | tcaagaangt | tctcangata | aacgctacaa | naaccgttag | cctcaaacca | 540 |
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 <213> *Oryza sativa*

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Ile Arg Asp Asp Lys Glu Xaa Glu Xaa Xaa Thr Ile Ile Asn Xaa Xaa
35 40 45

Gly Thr Glu Xaa Gly His Ile Ile Val Thr Thr Gly Gly Xaa Asn
50 55 60

Gly Xaa Pro Lys Xaa Thr Val Ser Tyr Met Ala Xaa Arg Ile Val Gly
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Gln Gly Ser Phe Gly Ile Val Phe Gln Ala Lys Phe Trp Arg Gln Gly
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Glu Thr Val Ala Ile Lys Xaa Val Leu
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| cggtgggt | ggcaccaact | tcgggttga | gagaagccag | tgggcatgga | gcagcagggt | 180 |
| ttgatagatt | gccagaggag | atgaacgata | tgaaaattag | ggatgataga | gaatggaaag | 240 |
| ccacagttgt | tgtatggcaac | ggaacggaga | cagcacatat | cattgtact | accattgggg | 300 |
| gtagaaatgg | tcagcccaag | cagactataa | gctacatggc | agagctgtt | gtagggcatg | 360 |
| gatcattgg | agtgttctc | caggctaagt | gcttggaaac | cgttact | gtggctatca | 420 |
| aaaagggtct | tcaagacaag | aggtacaaga | accgggagct | gcaaacaatg | cgcccttctt | 480 |
| accacccaaa | tgtcggtgct | ttgaagcaact | gtttctttc | aaccactgaa | aaggatgaac | 540 |
| tataccttaa | tttgggtctc | gaatatgtt | ctgaaacagt | taatcggtg | ataaaacatt | 600 |
| acaacaagtt | taaccaaagg | atgccactga | tatatgtaa | actctataca | taccagatct | 660 |
| ttagggcgtt | atcttatatt | catcggtgta | ttggagtctg | ccatcggat | atcaaggctc | 720 |
| aaaatctatt | ggtaatcca | cacactcacc | agttaaatt | atgtacttt | ggaagtgc当地 | 780 |
| aggttttgg | aaaaggcgaa | ccaaatatat | catacatatg | ttctagatac | tatagagcac | 840 |
| ctgagctcat | atttggcgca | actgaatata | ctacagccat | tgacgtctgg | tctgttggat | 900 |
| gtgttttagc | tgagctgctg | cttggacagc | ctctgttccc | ttgttagat | ggagttgatc | 960 |
| aacttgttga | gatcatcaag | gttctggca | ctccaacaag | ggaagagatt | aagtgc当地 | 1020 |
| accctaatta | tacagaattt | aaattccac | agattaaagc | acatccatgg | cacaagatct | 1080 |
| tccataagcg | catgcctcca | gaggctttg | atttggtatac | aagactacta | caataactccc | 1140 |
| ctaacttgcg | gtgcacagtt | tttagatgcct | tggacgcacc | ctttccccc | gacgaattcc | 1200 |
| gngatccaaa | tcctcgctt | ccaaatggc | cgatccntcc | aacaactatt | aattcaaaacc | 1260 |
| catgaactga | aagtgtccaa | ctgagatgg | ggaaaantgg | tcaaagcatg | caaggaacaa | 1320 |
| tgccgtttct | ggcttgaan | tgtacaaaac | tgaagtgtt | ttcatataga | atgcngctt | 1380 |
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Gly His Gly Ala Ala Gly Val Asp Arg Leu Pro Glu Glu Met Asn Asp
35 40 45

Met Lys Ile Arg Asp Asp Arg Glu Met Glu Ala Thr Val Val Asp Gly
50 55 60

Asn Gly Thr Glu Thr Gly His Ile Ile Val Thr Thr Ile Gly Gly Arg
65 70 75 80

Asn Gly Gln Pro Lys Gln Thr Ile Ser Tyr Met Ala Glu Arg Val Val
85 90 95

Gly His Gly Ser Phe Gly Val Val Phe Gln Ala Lys Cys Leu Glu Thr
100 105 110

Gly Glu Thr Val Ala Ile Lys Lys Val Leu Gln Asp Lys Arg Tyr Lys
115 120 125

Asn Arg Glu Leu Gln Thr Met Arg Leu Leu Asp His Pro Asn Val Val
130 135 140

Ala Leu Lys His Cys Phe Phe Ser Thr Thr Glu Lys Asp Glu Leu Tyr
145 150 155 160

Leu Asn Leu Val Leu Glu Tyr Val Pro Glu Thr Val Asn Arg Val Ile
165 170 175

Lys His Tyr Asn Lys Phe Asn Gln Arg Met Pro Leu Ile Tyr Val Lys
180 185 190

Leu Tyr Thr Tyr Gln Ile Phe Arg Ala Leu Ser Tyr Ile His Arg Cys
195 200 205

Ile Gly Val Cys His Arg Asp Ile Lys Pro Gln Asn Leu Leu Val Asn
210 215 220

Pro His Thr His Gln Val Lys Leu Cys Asp Phe Gly Ser Ala Lys Val
225 230 235 240

Leu Val Lys Gly Glu Pro Asn Ile Ser Tyr Ile Cys Ser Arg Tyr Tyr
245 250 255

Arg Ala Pro Glu Leu Ile Phe Gly Ala Thr Glu Tyr Thr Ala Ile
260 265 270

Asp Val Trp Ser Val Gly Cys Val Leu Ala Glu Leu Leu Gly Gln
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Pro Leu Phe Pro Gly Glu Ser Gly Val Asp Gln Leu Val Glu Ile Ile
290 295 300

Lys Val Leu Gly Thr Pro Thr Arg Glu Glu Ile Lys Cys Met Asn Pro
305 310 315 320

Asn Tyr Thr Glu Phe Lys Phe Pro Gln Ile Lys Ala His Pro Trp His
325 330 335

Lys Ile Phe His Lys Arg Met Pro Pro Glu Ala Val Asp Leu Val Ser
340 345 350

Arg Leu Leu Gln Tyr Ser Pro Asn Leu Arg Cys Thr Val Leu Asp Ala
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Leu Asp Ala Pro Phe Pro Leu Asp Glu Phe Arg Asp Pro Asn Pro Arg
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 35 40 45

Thr Ile Gly Gly Lys Asn Gly Glu Pro Lys Gln Thr Ile Ser Tyr Met
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Ala Glu Arg Val Val Gly Thr Gly Ser Phe Gly Ile Val Phe Gln Ala
 65 70 75 80

Lys Cys Leu Glu Thr Gly Glu Met Val Gly Ile Lys Lys Val Leu Gln
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Asp Arg Arg Tyr Lys Asn Arg Glu Leu Gln Leu Met Arg Ser Met Ile
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His Ser Asn Val Val Ser Leu Lys His Cys Phe Phe Ser Thr Thr Ser
 115 120 125

Arg Asp Glu Leu Phe Leu Asn Leu Val Met Glu Tyr Val Pro Glu Thr
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Leu Tyr Arg Val Leu Lys His Tyr Ser Asn Ala Asn Gln Gly Met Pro
 145 150 155 160

Leu Ile Tyr Val Lys Leu Tyr Met Tyr Gln Leu Phe Arg Gly Leu Ala
 165 170 175

Tyr Val His Thr Val Pro Gly Val Cys His Arg Asp Val Lys Pro Gln
 180 185 190

Asn Val Leu Val Asp Pro Leu Thr His Gln Val Lys Ile Cys Asp Phe
 195 200 205

Gly Ser Ala Lys Val Leu Val Pro Gly Glu Pro Asn Ile Ala Tyr Ile
 210 215 220

Cys Ser Arg Tyr Tyr Arg Ala Pro Glu Leu Ile Phe Gly Ala Thr Glu
 225 230 235 240

Tyr Thr Thr Ser Ile Asp Ile Trp Ser Ala Gly Cys Val Leu Ala Glu
 245 250 255

Leu Leu Leu Gly Gln Pro Leu Phe Pro Gly Glu Thr Ala Val Asp Gln
 260 265 270

Leu Val Glu Ile Ile Lys Val Leu Gly Thr Pro Thr Arg Glu Glu Ile
 275 280 285

Arg Cys Met Asn Pro Asn Tyr Thr Glu Phe Arg Phe Pro Gln Ile Lys
290 295 300

Ala His Pro Trp His Lys Ile Phe His Lys Arg Met Pro Ala Glu Ala
305 310 315 320

Ile Asp Leu Ala Ser Arg Leu Leu Gln Tyr Ser Pro Asn Leu Arg Cys
325 330 335

Thr Ala Leu Asp Ala Cys Ala His Ser Phe Phe Asp Glu Leu Arg Glu
340 345 350

Pro Asn Ala Arg Leu Pro Asn Gly Arg Pro Phe Pro Pro Leu Phe Asn
355 360 365

Phe Lys Pro Glu Leu Ala Asn Ala Ser Pro Glu Leu Ile Asn Arg Leu
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35 40 45

Gln Ser Ala Leu Pro Lys Pro Ala Ser Asp Val His His Val Ala Val
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Gln Ser Glu Ala Pro Glu Pro Val Lys Ile Ala Ala Tyr His Ser Glu
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Pro Ala Pro Ala Val Arg Ser Glu Ala Pro Glu Pro Val Lys Ile Ala
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Ala Ser His Ser Glu Pro Ala Pro Met Ala Ala Lys Pro Gly Gly Ala
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Lys Arg Val Ser Ser Ala Gly Leu Leu Leu Gly Ser Val Leu Arg Arg
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Gln Gly Gln Phe Gly Thr Thr His Leu Cys Val Glu Arg Ala Thr Gly
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 Lys Glu Leu Ala Cys Lys Ser Ile Leu Lys Arg Lys Leu Gly Ser Asp
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 Asp Asp Val Glu Asp Val Arg Arg Glu Ile Gln Ile Met His His Leu
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 Val Ala Val His Leu Val Met Glu Leu Cys Gly Gly Glu Leu Phe
 225 230 235 240
 Asp Arg Ile Val Arg Arg Gly His Tyr Thr Glu Arg Lys Ala Ala Glu
 245 250 255
 Leu Ala Arg Val Ile Val Gly Val Val Glu Ala Cys His Ser Met Gly
 260 265 270
 Val Met His Arg Asp Leu Lys Pro Glu Asn Phe Leu Phe Ala Asp His
 275 280 285
 Ser Glu Glu Ala Ala Leu Lys Thr Ile Asp Phe Gly Leu Ser Ile Phe
 290 295 300
 Phe Arg Pro Gly Gln Ile Phe Thr Asp Val Val Gly Ser Pro Tyr Tyr
 305 310 315 320
 Val Ala Pro Glu Val Leu Lys Lys Arg Tyr Gly Pro Glu Ala Asp Val
 325 330 335
 Trp Ser Ala Gly Val Ile Ile Tyr Ile Leu Leu Cys Gly Val Pro Pro
 340 345 350
 Phe Trp Ala Glu Asn Glu Gln Gly Ile Phe Glu Glu Val Leu His Gly
 355 360 365
 Arg Leu Asp Phe Glu Ser Glu Pro Trp Pro Ser Ile Ser Asp Gly Ala
 370 375 380
 Lys Asp Leu Val Arg Arg Met Leu Val Arg Asp Pro Arg Lys Arg Leu
 385 390 395 400
 Thr Ala His Glu Val Leu Arg His Pro Trp Val Gln Val Gly Gly Val
 405 410 415
 Ala Pro Asp Arg Pro Leu Asp Ser Ala Val Leu Ser Arg Met Lys Gln
 420 425 430
 Phe Ser Ala Met Asn Lys Leu Lys Lys Met Ala Leu Arg Val Ile Ala
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 Glu Asn Leu Ser Glu Asp Glu Ile Ala Gly Leu Arg Glu Met Phe Lys
 450 455 460
 Met Ile Asp Ala Asp Asn Ser Gly Gln Ile Thr Phe Glu Glu Leu Lys
 465 470 475 480

Val Gly Leu Glu Lys Val Gly Ala Asn Leu Gln Glu Ser Glu Ile Tyr
 485 490 495
 Ala Leu Met Gln Ala Ala Asp Val Asp Asn Asn Gly Thr Ile Asp Tyr
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 Gly Glu Phe Ile Ala Ala Thr Leu His Leu Asn Lys Val Glu Arg Glu
 515 520 525
 Asp His Leu Phe Ala Ala Phe Gln Tyr Phe Asp Lys Asp Gly Ser Gly
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 Tyr Ile Thr Ala Asp Glu Leu Gln Val Ala Cys Glu Glu Phe Gly Leu
 545 550 555 560
 Gly Asp Val Gln Leu Glu Asp Leu Ile Gly Glu Val Asp Gln Asp Asn
 565 570 575
 Asp Gly Arg Ile Asp Tyr Asn Glu Phe Val Ala Met Met Gln Lys Pro
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 Thr Val Gly Gly Ser Arg Arg Arg Pro Ile Cys Arg Thr Ala Ser Ala
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 Ser Gly Ser Thr Thr Pro Val His His Gln Ala Ala Thr Pro Gly
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 Ala Ala Ala Trp Pro Ser Pro Tyr Pro Ala Gly Gly Ala Ser Pro Leu
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 Phe Lys Arg Pro Phe Pro Pro Ser Pro Ala Lys His Ile Lys Ala
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 Thr Leu Ala Lys Arg Leu Gly Gly Lys Pro Lys Glu Gly Thr Ile
 115 120 125

Pro Glu Glu Gly Gly Ala Gly Ala Gly Ala Gly Ala Gly Ala
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 Gly Ala Ala Val Gly Ala Ala Asp Ser Ala Glu Ala Asp Arg Pro Leu
 145 150 155 160
 Asp Lys Thr Phe Gly Phe Ala Lys Asn Phe Gly Ala Lys Tyr Asp Leu
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 Gly Lys Glu Val Gly Arg Gly His Phe Gly His Thr Cys Ser Ala Val
 180 185 190
 Val Lys Lys Gly Glu His Lys Gly His Thr Val Ala Val Lys Ile Ile
 195 200 205
 Ser Lys Ala Lys Met Thr Thr Ala Ile Ser Ile Glu Asp Val Arg Arg
 210 215 220
 Glu Val Lys Ile Leu Lys Ala Leu Ser Gly His Asp Asn Leu Val Arg
 225 230 235 240
 Phe Tyr Asp Ala Cys Glu Asp Ala Leu Asn Val Tyr Ile Val Met Glu
 245 250 255
 Leu Cys Glu Gly Gly Glu Leu Leu Asp Arg Ile Leu Ala Arg Gly Gly
 260 265 270
 Arg Tyr Thr Glu Glu Asp Ala Lys Ala Ile Ile Val Gln Ile Leu Ser
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 Val Val Ala Phe Cys His Leu Gln Gly Val Val His Arg Asp Leu Lys
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 Pro Glu Asn Phe Leu Phe Thr Thr Arg Asp Glu Ser Ala Pro Met Lys
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 325 330 335
 Asn Asp Ile Val Gly Ser Ala Tyr Tyr Val Ala Pro Glu Val Leu His
 340 345 350
 Arg Ser Tyr Ser Met Glu Ala Asp Ile Trp Ser Ile Gly Val Ile Thr
 355 360 365
 Tyr Ile Leu Leu Cys Gly Ser Arg Pro Phe Trp Ala Arg Thr Glu Ser
 370 375 380
 Gly Ile Phe Arg Ser Val Leu Arg Ala Asp Pro Asn Phe Asp Asp Ser
 385 390 395 400
 Pro Trp Pro Ser Val Ser Ala Glu Ala Lys Asp Phe Val Lys Arg Phe
 405 410 415
 Leu Asn Lys Asp Tyr Arg Lys Arg Met Thr Ala Val Gln Ala Leu Thr
 420 425 430
 His Pro Trp Leu Arg Asp Glu Gln Arg Gln Ile Pro Leu Asp Ile Leu
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Ile Phe Arg Leu Val Lys Gln Tyr Leu Arg Ala Thr Pro Leu Lys Arg
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 Leu Ala Leu Lys Ala Leu Ser Lys Ala Leu Ser Glu Asp Glu Leu Leu
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 Ala Phe Gln His Phe Glu Gln Glu Gly Asn Arg Val Ile Ser Val Glu
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 Glu Leu Ala Gln Glu Leu Asn Leu Ala Pro Thr His Tyr Ser Ile Val
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 Gln Asp Trp Ile Arg Lys Ser Asp Gly Lys Leu Asn Phe Leu Gly Phe
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 Leu Phe Lys Ser Ser Pro Ser Val Ser Ser Val Ser Ser Thr Pro
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 Leu Arg Ile Phe Lys Arg Pro Phe Pro Pro Pro Ser Pro Ala Lys His
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 Ile Arg Ala Phe Leu Ala Arg Arg Tyr Gly Ser Val Lys Pro Asn Glu
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| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Ser | Ile | Pro | Glu | Gly | Lys | Glu | Cys | Glu | Ile | Gly | Leu | Asp | Lys | Ser |
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| Phe | Gly | Phe | Ser | Lys | Gln | Phe | Ala | Ser | His | Tyr | Glu | Ile | Asp | Gly | Glu |
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| Val | Gly | Arg | Gly | His | Phe | Gly | Tyr | Thr | Cys | Ser | Ala | Lys | Gly | Lys | Lys |
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| Gly | Ser | Leu | Lys | Gly | Gln | Glu | Val | Ala | Val | Lys | Val | Ile | Pro | Lys | Ser |
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| Lys | Met | Thr | Thr | Ala | Ile | Ala | Ile | Glu | Asp | Val | Ser | Arg | Glu | Val | Lys |
| | 165 | | | | | | | 170 | | | | | 175 | | |
| Met | Leu | Arg | Ala | Leu | Thr | Gly | His | Lys | Asn | Leu | Val | Gln | Phe | Tyr | Asp |
| | 180 | | | | | | | 185 | | | | | 190 | | |
| Ala | Phe | Glu | Asp | Asp | Glu | Asn | Val | Tyr | Ile | Val | Met | Glu | Leu | Cys | Lys |
| | 195 | | | | | 200 | | | | | | 205 | | | |
| Gly | Gly | Glu | Leu | Leu | Asp | Lys | Ile | Leu | Gln | Arg | Gly | Gly | Lys | Tyr | Ser |
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| Glu | Asp | Asp | Ala | Lys | Lys | Val | Met | Val | Gln | Ile | Leu | Ser | Val | Val | Ala |
| | 225 | | | | | 230 | | | | 235 | | | | | 240 |
| Tyr | Cys | His | Leu | Gln | Gly | Val | Val | His | Arg | Asp | Leu | Lys | Pro | Glu | Asn |
| | 245 | | | | | 250 | | | | 255 | | | | | |
| Phe | Leu | Phe | Ser | Thr | Lys | Asp | Glu | Thr | Ser | Pro | Leu | Lys | Ala | Ile | Asp |
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| Phe | Gly | Leu | Ser | Asp | Tyr | Val | Lys | Pro | Asp | Glu | Arg | Leu | Asn | Asp | Ile |
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| Val | Gly | Ser | Ala | Tyr | Tyr | Val | Ala | Pro | Glu | Val | Leu | His | Arg | Thr | Tyr |
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| Gly | Thr | Glu | Ala | Asp | Met | Trp | Ser | Ile | Gly | Val | Ile | Ala | Tyr | Ile | Leu |
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| Leu | Cys | Gly | Ser | Arg | Pro | Phe | Trp | Ala | Arg | Thr | Glu | Ser | Gly | Ile | Phe |
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| Arg | Ala | Val | Leu | Lys | Ala | Glu | Pro | Asn | Phe | Glu | Glu | Ala | Pro | Trp | Pro |
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| Ser | Leu | Ser | Pro | Glu | Ala | Val | Asp | Phe | Val | Lys | Arg | Leu | Leu | Asn | Lys |
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| Asp | Tyr | Arg | Lys | Arg | Leu | Thr | Ala | Ala | Gln | Ala | Leu | Cys | His | Pro | Trp |
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| Leu | Val | Gly | Ser | His | Glu | Leu | Lys | Ile | Pro | Ser | Asp | Met | Ile | Ile | Tyr |
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| Lys | Leu | Val | Lys | Val | Tyr | Ile | Met | Ser | Thr | Ser | Leu | Arg | Lys | Ser | Ala |
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 Met Gln Asn Tyr Lys Thr Ala Ile Leu Lys Ser Ser Thr Asp Ala Met
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 Tyr Lys Lys Leu Asp Phe Glu Phe Cys Ala Ser Ala Leu Ser Val
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 Tyr Gln Leu Glu Ala Met Glu Thr Trp Glu Gln His Ala Arg Arg Ala
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 Tyr Glu Leu Phe Glu Lys Asp Gly Asn Arg Pro Ile Met Ile Glu Glu
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 Leu Ala Ser Glu Leu Gly Leu Gly Pro Ser Val Pro Val His Val Val
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 Gly His Ile Ile Val Thr Thr Ile Gly Gly Arg Asn Gly Gln Pro Lys
 50 55 60
 Gln Thr Ile Ser Tyr Met Ala Glu Arg Val Val Gly His Gly Ser Phe
 65 70 75 80
 Gly Val Val Phe Gln Ala Lys Cys Leu Glu Thr Gly Glu Thr Val Ala
 85 90 95
 Ile Lys Lys Val Leu Gln Asp Arg Arg Tyr Lys Asn Arg Glu Leu Gln
 100 105 110
 Thr Met Arg Leu Leu Asp His Pro Asn Val Val Ser Leu Lys His Cys
 115 120 125

Phe Phe Ser Thr Thr Glu Lys Asp Glu Leu Tyr Leu Asn Leu Val Leu
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 Glu Tyr Val Pro Glu Thr Val His Arg Val Ile Lys His Tyr Asn Lys
 145 150 155 160
 Leu Asn Gln Arg Met Pro Leu Ile Tyr Val Lys Leu Tyr Thr Tyr Gln
 165 170 175
 Ile Phe Arg Ala Leu Ser Tyr Ile His Arg Cys Ile Gly Val Cys His
 180 185 190
 Arg Asp Ile Lys Pro Gln Asn Leu Leu Val Asn Pro His Thr His Gln
 195 200 205
 Val Lys Leu Cys Asp Phe Gly Ser Ala Lys Val Leu Val Lys Gly Glu
 210 215 220
 Pro Asn Ile Ser Tyr Ile Cys Ser Arg Tyr Tyr Arg Ala Pro Glu Leu
 225 230 235 240
 Ile Phe Gly Ala Thr Glu Tyr Thr Thr Ala Ile Asp Val Trp Ser Ala
 245 250 255
 Gly Cys Val Leu Ala Glu Leu Leu Gly Gln Pro Leu Phe Pro Gly
 260 265 270
 Glu Ser Gly Val Asp Gln Leu Val His Ile Ile Lys Val Leu Gly Thr
 275 280 285
 Pro Thr Arg Glu Glu Ile Lys Cys Met Asn Pro Asn Tyr Thr Glu Phe
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 Lys Phe Pro Gln Ile Lys Ala His Pro Trp His Lys Ile Phe His Lys
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 Arg Met Pro Pro Glu Ala Val Asp Leu Val Ser Arg Leu Leu Gln Tyr
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 Ser Pro Asn Leu Arg Ser Ala Ala Leu Asp Thr Leu Val His Pro Phe
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 Phe Asp Glu Leu Arg Asp Pro Asn Ala Arg Leu Pro Asn Gly Arg Phe
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 Leu Pro Pro Ala Phe His Phe Lys Pro His Glu Leu Lys Gly Val Pro
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Gly Asn Gly Thr Glu Thr Gly His Ile Ile Val Thr Thr Ile Gly Gly
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Lys Asn Gly Gln Pro Lys Gln Thr Ile Ser Tyr Met Ala Glu Arg Val
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Val Gly His Gly Ser Phe Gly Val Val Phe Gln Ala Lys Cys Leu Glu
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Thr Gly Glu Thr Val Ala Ile Lys Lys Val Leu Gln Asp Lys Arg Tyr
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Lys Asn Arg Glu Leu Gln Thr Met Arg Leu Leu Asp His Pro Asn Val
 115 120 125

Val Ser Leu Lys His Cys Phe Phe Ser Thr Thr Glu Lys Asp Glu Leu
 130 135 140

Tyr Leu Asn Leu Val Leu Glu Tyr Val Pro Glu Thr Val Ser Arg Val
 145 150 155 160

Ile Arg His Tyr Asn Lys Met Asn Gln Arg Met Pro Met Ile Tyr Val
 165 170 175

Lys Leu Tyr Ser Tyr Gln Ile Cys Arg Ala Leu Ala Tyr Ile His Asn
 180 185 190

Ser Ile Gly Val Cys His Arg Asp Ile Lys Pro Gln Asn Leu Leu Val
 195 200 205

Asn Pro His Thr His Gln Leu Lys Ile Cys Asp Phe Gly Ser Ala Lys
 210 215 220

Val Leu Val Lys Gly Glu Pro Asn Ile Ser Tyr Ile Cys Ser Arg Tyr
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Tyr Arg Ala Pro Glu Leu Ile Phe Gly Ala Thr Glu Tyr Thr Thr Ala
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Ile Asp Ile Trp Ser Ala Gly Cys Val Leu Gly Glu Leu Leu Gly
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Gln Pro Leu Phe Pro Gly Glu Ser Gly Val Asp Gln Leu Val Glu Ile
 275 280 285

Ile Lys Val Leu Gly Thr Pro Thr Arg Glu Glu Ile Lys Cys Met Asn
 290 295 300

Pro Asn Tyr Thr Glu Phe Lys Phe Pro Gln Ile Lys Ala His Pro Trp
 305 310 315 320

| | | | | | | | | | | | | | | | |
|-------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| His | Lys | Ile | Phe | His | Lys | Arg | Met | Pro | Pro | Glu | Ala | Val | Asp | Leu | Val |
| | | | | | | | 325 | | | 330 | | | | 335 | |
| Ser | Arg | Leu | Leu | Gln | Tyr | Ser | Pro | Asn | Leu | Arg | Ser | Thr | Ala | Leu | Glu |
| | | | | | | | 340 | | | 345 | | | | 350 | |
| Ala | Leu | Val | His | Pro | Phe | Tyr | Asp | Asp | Val | Arg | Asp | Pro | Asn | Thr | Arg |
| | | | | | | | 355 | | | 360 | | | | 365 | |
| Leu | Pro | Asn | Gly | Arg | Phe | Leu | Pro | Pro | Leu | Phe | Asn | Phe | Lys | Val | Asn |
| | | | | | | | 370 | | | 375 | | | | 380 | |
| Glu | Leu | Lys | Gly | Val | Pro | Ala | Glu | Met | Leu | Val | Lys | Leu | Val | Pro | Pro |
| | | | | | | | 385 | | | 390 | | | | 395 | |
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| Asp | Met | Lys | Ile | Arg | Asp | Asp | Arg | Glu | Met | Glu | Ala | Thr | Val | Val | Asp |
| | | | | | | | 35 | | | 40 | | | 45 | | |
| Gly | Asn | Gly | Thr | Glu | Thr | Gly | His | Ile | Ile | Val | Thr | Thr | Ile | Gly | Gly |
| | | | | | | | 50 | | | 55 | | | 60 | | |
| Arg | Asn | Gly | Gln | Pro | Lys | Gln | Thr | Ile | Ser | Tyr | Met | Ala | Glu | Arg | Val |
| | | | | | | | 65 | | | 70 | | | 75 | | 80 |
| Val | Gly | His | Gly | Ser | Phe | Gly | Val | Val | Phe | Gln | Ala | Lys | Cys | Leu | Glu |
| | | | | | | | 85 | | | 90 | | | 95 | | |
| Thr | Gly | Glu | Thr | Val | Ala | Ile | Lys | Lys | Val | Leu | Gln | Asp | Lys | Arg | Tyr |
| | | | | | | | 100 | | | 105 | | | 110 | | |
| Lys | Asn | Arg | Glu | Leu | Gln | Thr | Met | Arg | Leu | Leu | Asp | His | Pro | Asn | Val |
| | | | | | | | 115 | | | 120 | | | 125 | | |
| Val | Ser | Leu | Lys | His | Cys | Phe | Phe | Ser | Thr | Thr | Glu | Lys | Asp | Glu | Leu |
| | | | | | | | 130 | | | 135 | | | 140 | | |
| Tyr | Leu | Asn | Leu | Val | Leu | Glu | Tyr | Val | Pro | Glu | Thr | Val | His | Arg | Val |
| | | | | | | | 145 | | | 150 | | | 155 | | 160 |
| Ile | Lys | His | Tyr | Ser | Lys | Leu | Asn | Gln | Arg | Met | Pro | Met | Ile | Tyr | Val |
| | | | | | | | 165 | | | 170 | | | 175 | | |
| Lys | Leu | Tyr | Thr | Tyr | Gln | Ile | Phe | Arg | Ala | Leu | Ser | Tyr | Ile | His | Arg |
| | | | | | | | 180 | | | 185 | | | 190 | | |

Cys Ile Gly Val Cys His Arg Asp Ile Lys Pro Gln Asn Leu Leu Val
 195 200 205
 Asn Pro His Thr His Gln Val Lys Leu Cys Asp Phe Gly Ser Ala Lys
 210 215 220
 Val Leu Val Lys Gly Glu Pro Asn Ile Ser Tyr Ile Cys Ser Arg Tyr
 225 230 235 240
 Tyr Arg Ala Pro Glu Leu Ile Phe Gly Ala Thr Glu Tyr Thr Ala
 245 250 255
 Ile Asp Val Trp Ser Val Gly Cys Val Leu Ala Glu Leu Leu Gly
 260 265 270
 Gln Pro Leu Phe Pro Gly Glu Arg Gly Val Asp Gln Leu Val Glu Ile
 275 280 285
 Ile Lys Val Leu Gly Thr Pro Thr Arg Glu Glu Ile Lys Cys Met Asn
 290 295 300
 Pro Asn Tyr Thr Glu Phe Lys Phe Pro Gln Ile Lys Ala His Pro Trp
 305 310 315 320
 His Lys Ile Phe His Lys Arg Met Pro Ala Glu Ala Val Asp Leu Val
 325 330 335
 Ser Arg Leu Leu Gln Tyr Ser Pro Asn Leu Arg Cys Gln Ala Leu Asp
 340 345 350
 Cys Leu Thr His Pro Phe Phe Asp Glu Leu Arg Asp Pro Asn Ala Arg
 355 360 365
 Leu Pro Thr Gly Arg Phe Leu Pro Pro Leu Phe Asn Phe Lys Pro His
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 His Ala Arg Lys Gln Cys Pro Phe Leu Gly Leu
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 Leu Gln Leu His Asp Gly Asp Ala Leu Lys Arg Arg Pro Glu Leu Asp
 20 25 30
 Ser Asp Lys Glu Met Ser Ala Ala Val Ile Glu Gly Asn Asp Ala Val
 35 40 45
 Thr Gly His Ile Ile Ser Thr Thr Ile Gly Gly Lys Asn Gly Glu Pro
 50 55 60

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Lys | Gln | Thr | Ile | Ser | Tyr | Met | Ala | Glu | Arg | Val | Val | Gly | Thr | Gly | Ser |
| 65 | | | | | | | | | | | | | | | 80 |
| Phe | Gly | Ile | Val | Phe | Gln | Ala | Lys | Cys | Leu | Glu | Thr | Gly | Glu | Ser | Val |
| | | | | | | | | | | | | | | | 95 |
| Ala | Ile | Lys | Lys | Val | Leu | Gln | Asp | Arg | Arg | Tyr | Lys | Asn | Arg | Glu | Leu |
| | | | | | | | | | | | | | | | 110 |
| Gln | Leu | Met | Arg | Pro | Met | Asp | His | Pro | Asn | Val | Ile | Ser | Leu | Lys | His |
| | | | | | | | | | | | | | | | 125 |
| Cys | Phe | Phe | Ser | Thr | Thr | Ser | Arg | Asp | Glu | Leu | Phe | Leu | Asn | Leu | Val |
| | | | | | | | | | | | | | | | 140 |
| Met | Glu | Tyr | Val | Pro | Glu | Thr | Leu | Tyr | Arg | Val | Leu | Arg | His | Tyr | Thr |
| 145 | | | | | | | | | | | | | | | 160 |
| Ser | Ser | Asn | Gln | Arg | Met | Pro | Ile | Phe | Tyr | Val | Lys | Leu | Tyr | Thr | Tyr |
| | | | | | | | | | | | | | | | 175 |
| Gln | Ile | Phe | Arg | Gly | Leu | Ala | Tyr | Ile | His | Thr | Val | Pro | Gly | Val | Cys |
| | | | | | | | | | | | | | | | 190 |
| His | Arg | Asp | Val | Lys | Pro | Gln | Asn | Leu | Leu | Val | Asp | Pro | Leu | Thr | His |
| | | | | | | | | | | | | | | | 205 |
| Gln | Val | Lys | Leu | Cys | Asp | Phe | Gly | Ser | Ala | Lys | Val | Leu | Val | Lys | Gly |
| | | | | | | | | | | | | | | | 220 |
| Glu | Pro | Asn | Ile | Ser | Tyr | Ile | Cys | Ser | Arg | Tyr | Tyr | Arg | Ala | Pro | Glu |
| 225 | | | | | | | | | | | | | | | 240 |
| Leu | Ile | Phe | Gly | Ala | Thr | Glu | Tyr | Thr | Ala | Ser | Ile | Asp | Ile | Trp | Ser |
| | | | | | | | | | | | | | | | 255 |
| Ala | Gly | Cys | Val | Leu | Ala | Glu | Leu | Leu | Gly | Gln | Pro | Leu | Phe | Pro | |
| | | | | | | | | | | | | | | | 270 |
| Gly | Glu | Asn | Ser | Val | Asp | Gln | Leu | Val | Glu | Ile | Ile | Lys | Val | Leu | Gly |
| | | | | | | | | | | | | | | | 285 |
| Thr | Pro | Thr | Arg | Glu | Glu | Ile | Arg | Cys | Met | Asn | Pro | Asn | Tyr | Thr | Asp |
| | | | | | | | | | | | | | | | 300 |
| Phe | Arg | Phe | Pro | Gln | Ile | Lys | Ala | His | Pro | Trp | His | Lys | Val | Phe | His |
| 305 | | | | | | | | | | | | | | | 320 |
| Lys | Arg | Met | Pro | Pro | Glu | Ala | Ile | Asp | Leu | Ala | Ser | Arg | Leu | Leu | Gln |
| | | | | | | | | | | | | | | | 335 |
| Tyr | Ser | Pro | Ser | Leu | Arg | Cys | Thr | Ala | Leu | Glu | Ala | Cys | Ala | His | Pro |
| | | | | | | | | | | | | | | | 350 |
| Phe | Phe | Asn | Glu | Leu | Arg | Glu | Pro | Asn | Ala | Arg | Leu | Pro | Asn | Gly | Arg |
| | | | | | | | | | | | | | | | 365 |
| Pro | Leu | Pro | Pro | Leu | Phe | Asn | Phe | Lys | Gln | Glu | Leu | Gly | Gly | Ala | Ser |
| | | | | | | | | | | | | | | | 380 |

Met Glu Leu Ile Asn Arg Leu Ile Pro Glu His Val Arg Arg Gln Met
385 390 395 400
Ser Thr Gly Leu Gln Asn Ser
405